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May 15, 1981

Mr. Jack Robinson
Harza Engineering Company
150 So. Wacker Drive
Chicago, Illinois 60606

Dear Jack,

I believe you will be pleased with the results of the outmigrant fry trapping. It was an effective team effort between Sandy Milner, Leigh Smith and myself.

This work raises some questions which are pertiment to the objectives of the Black Bear Lake project investigations. These questions should be considered in future work.

I will look forward to discussing further investigations on this project with you.

Sincerely,

Daniel M. Bishop

Daniel M. Bishop

DMB/eb

This is a report submitted by Bishop as per Collecting Permit
Don has a copy

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PRELIMINARY STUDY OF OUTMIGRANT FRY FROM BLACK BEAR CREEK, PRINCE OF WALES ISLAND, ALASKA

ALEXANDER MILNER

May 15, 1981

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Introduction :-

The principal aim of the project was to estimate the timing and relative size of the outmigration of pink (Oncorhynchus gorbuscha) and chum (Onchorhynchus keta) salmon fry from the Black Bear Creek system, Prince of Wales Island in the spring of 1981. Other salmonid species were also recorded and in addition an attempt was made to ascertain the species composition of the outmigration from the section of stream above Black Lake. Both pink and chum salmon fry normally migrate directly to sea after emergence from the gravel in spring, having been spawned the previous summer/fall.

Methods:-

A fyke net with a 3ft x 3ft internal opening and $^{3}/16$ ths inch mesh was used at a suitable site located approximately one third of a mile from the estuary and with excellent access from the bank. A steel cable was fixed across the stream between two trees to which the fyke net was attached using trolling wire. By the use of clips and cable clamps a set-up was installed that allowed for easy withdrawl and placement of the net in the stream as required. A 5ft x 3ft x 2ft live box attached to the end of the net was supported by trolling wire and faciliated holding of the fry after capture. (see photographs in appendix)

The net was fished with the aid of local help being installed towards sunset and emptied the next morning. The work commenced on the evening of March 17, initially being fished every 3 nights,but this was changed to every two nights as the run increased, circumstances permitting. The study was continued until April 22 when it was concluded that the principal outmigration of pink and chum was over.

Total counts of pink and chum fry were made and where numbers exceeded 1000 this was achieved by weighing the total number of fish and then weighing a representative sub-sample. Fork lengths and weights were made on approximately 50 fish of each species (pink and chum) for each operation of the net.

Water depths as an indication of relative stream discharge were measured using a graduated staff attached to a piece of piping driven into the stream bed.

On April 26 the net was installed using a similar set-up and proceedure at the mouth of the inlet stream into Black Lake and was fished for three nights. The location of these two sampling sites is shown on the map.

A neligible mortality of fry occurred during the operation of this sampling programme.

Minnow traps baited with salmon eggs were set in the beaver ponds near the entrance of the stream into Black Lake to ascertain if any rearing salmonids were present in this habitat.

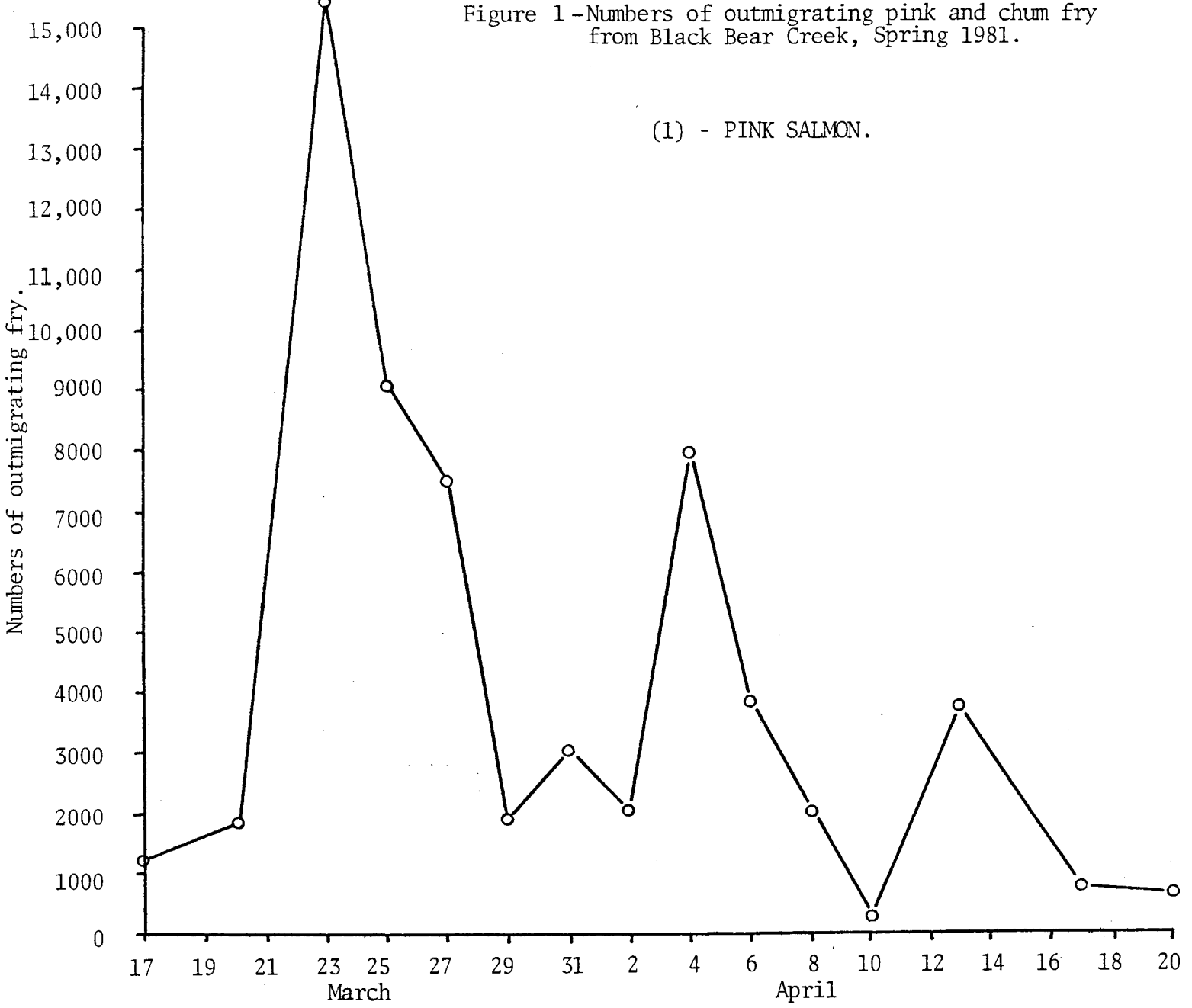
Results :-

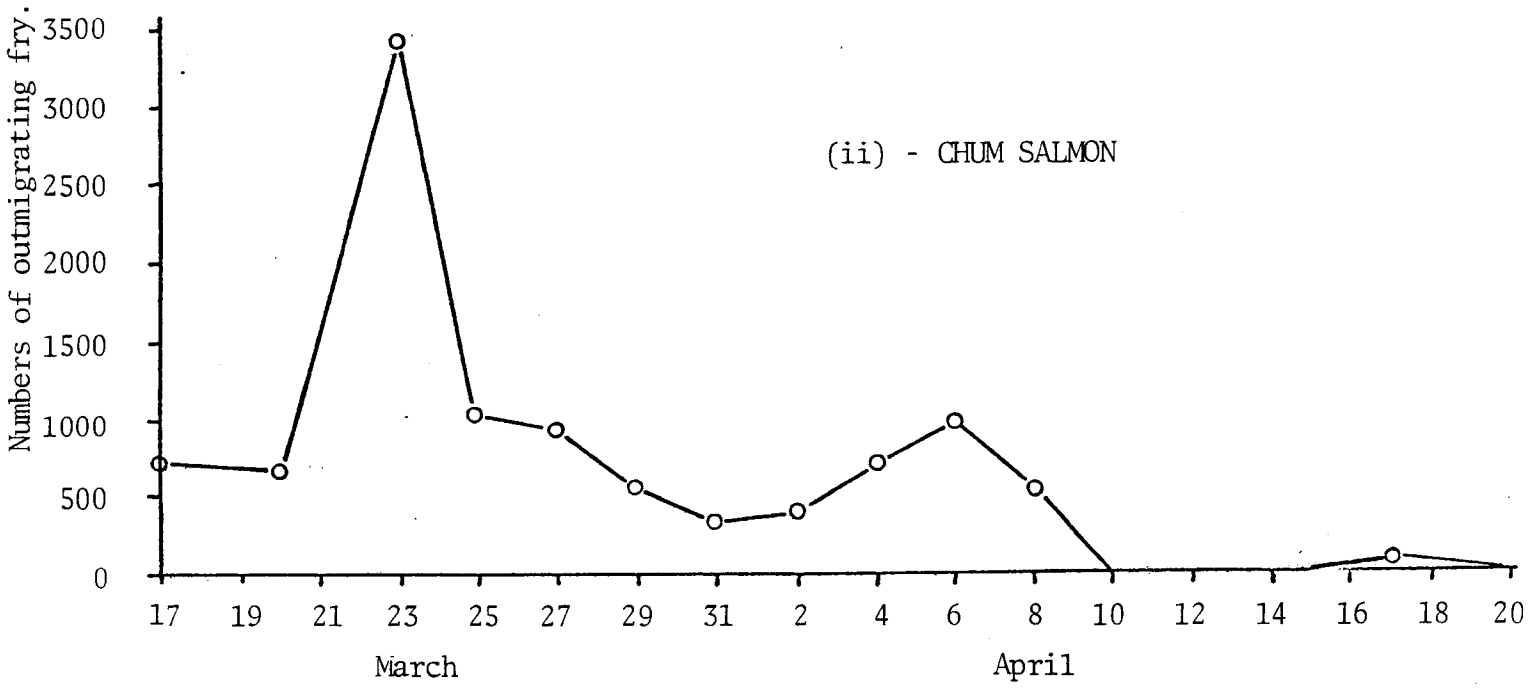
Numbers of outmigrating pink and chum salmon fry for each set of the fyke net near the mouth of the stream are plotted against date of the month in Figure 1 to give an indication of timing. Points for March 27 are estimated from visual observations of the life box at midnight of the set. A susequent unexpected rapid rise of the river caused the live box to become submerged and it was a testimony to the robustness of the installation that no gear was lost.

The numbers of outmigrating fry for each species are compared with temperature and water depth values of the stream at the dates of sampling in Figures 2 and 3. Length frequency distributions of the fry are given in Table 1 and are plotted as histograms in Figure 4. Length-weight regressions for each species are given in Figures 5 and 6.

A number of coho fry and smolt were taken in the net operation near the estuary. Smolts were found in most settings but never exceeded 9. Coho fry (Oncorhynchus kisutch) were first taken on March 31 and then throughout the operation, the largest number being caught was 257.

Figure 1 - Numbers of outmigrating pink and chum fry from Black Bear Creek, Spring 1981.





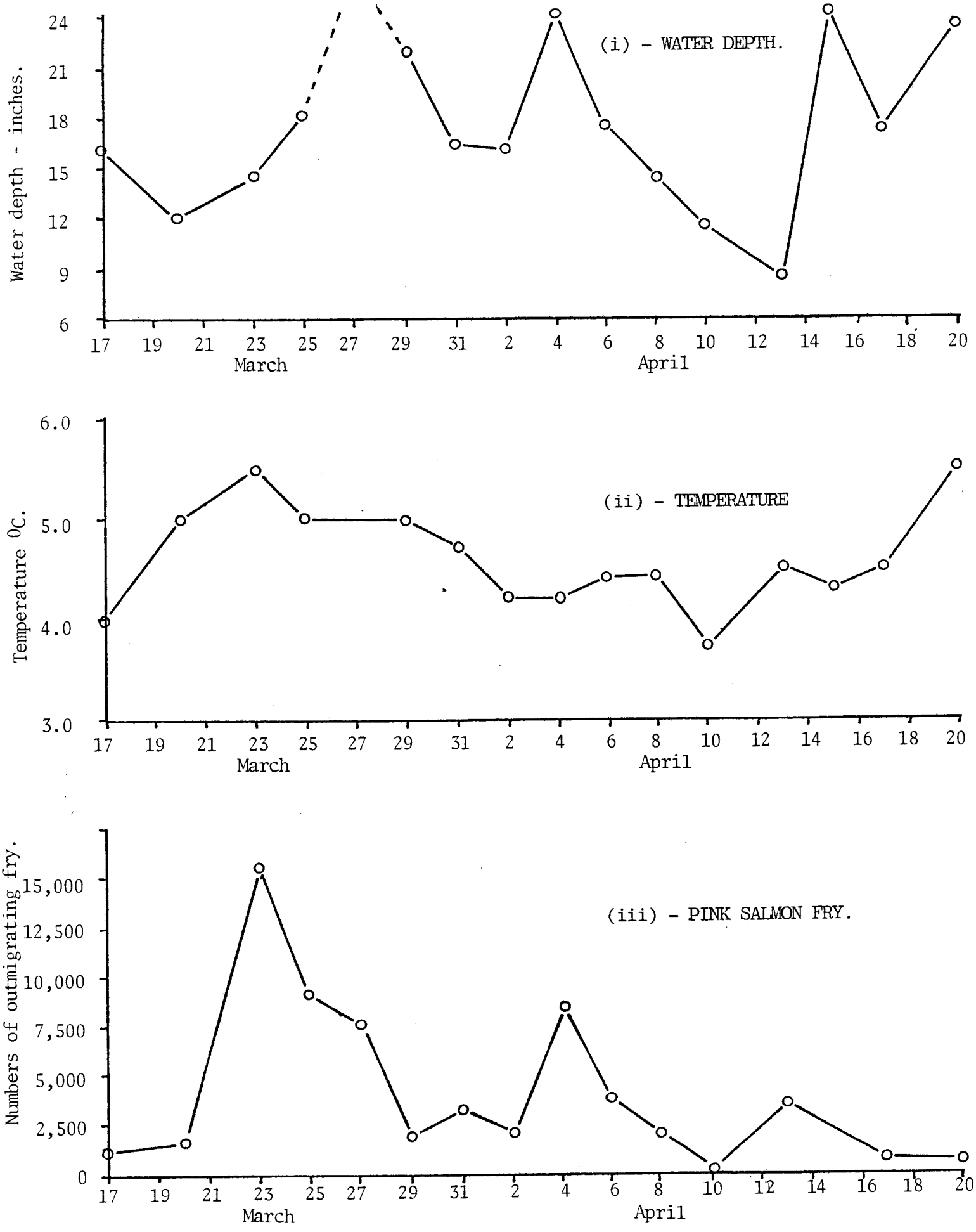
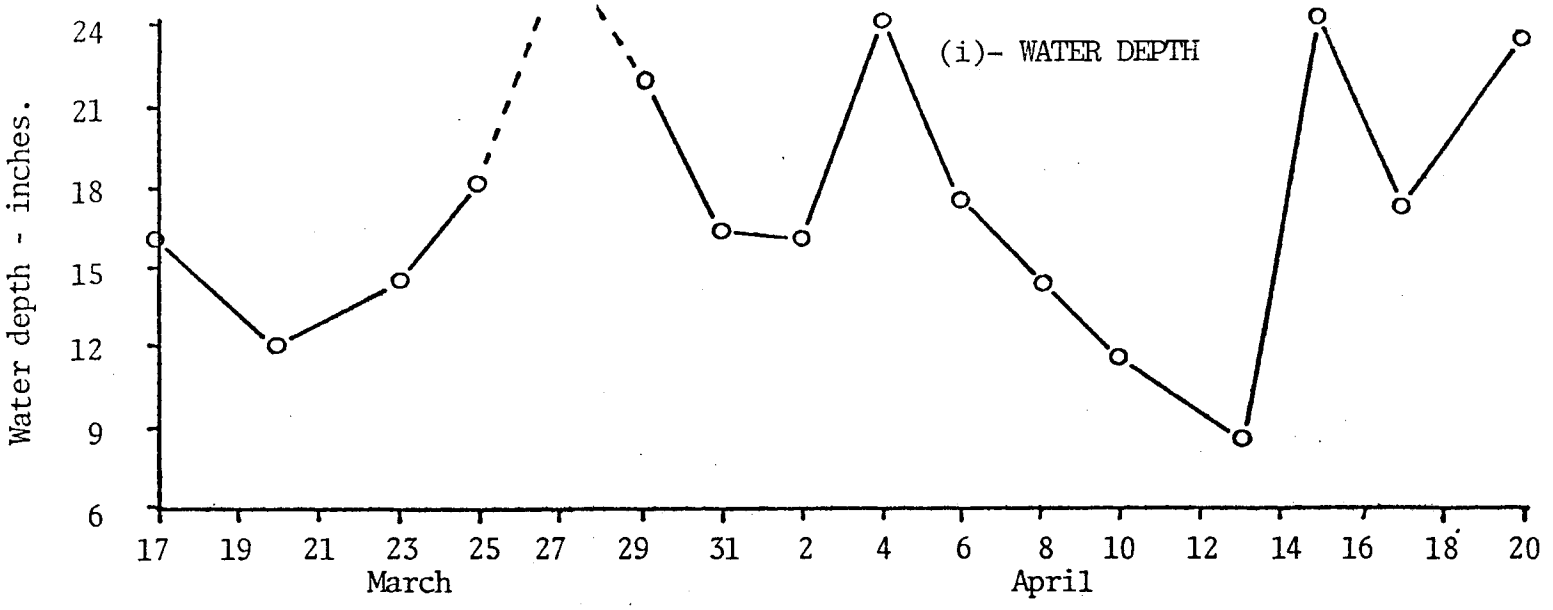
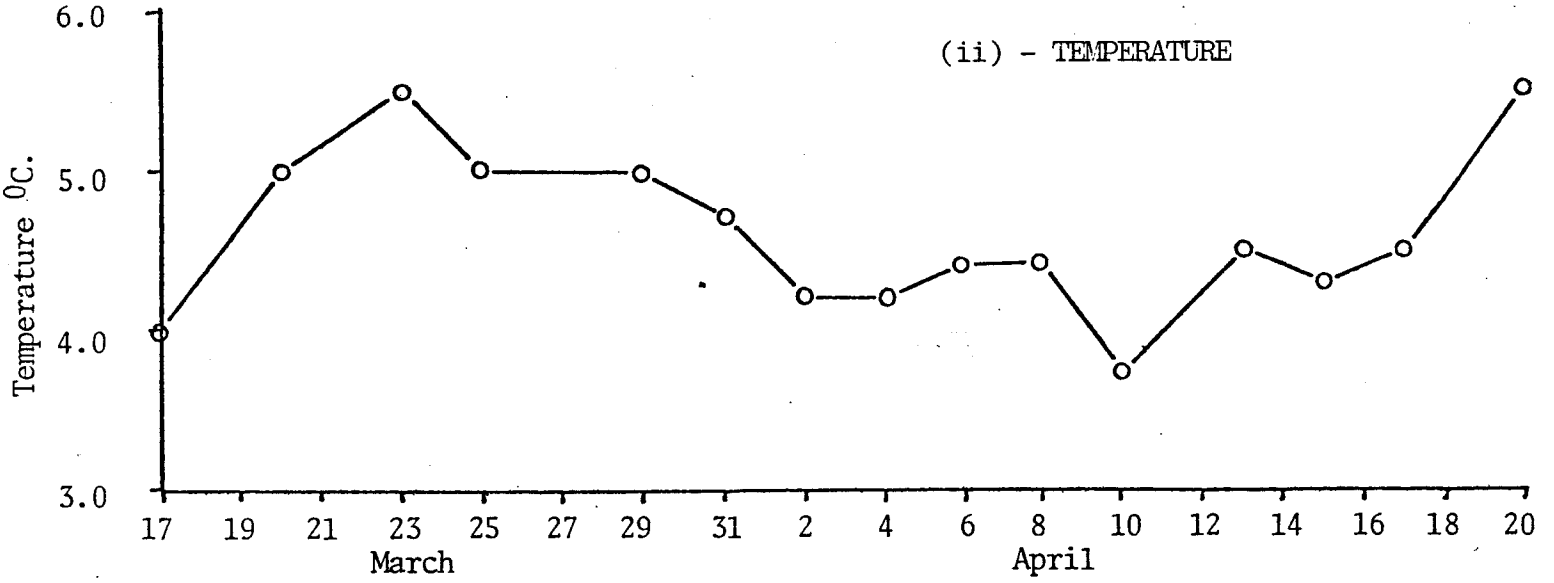
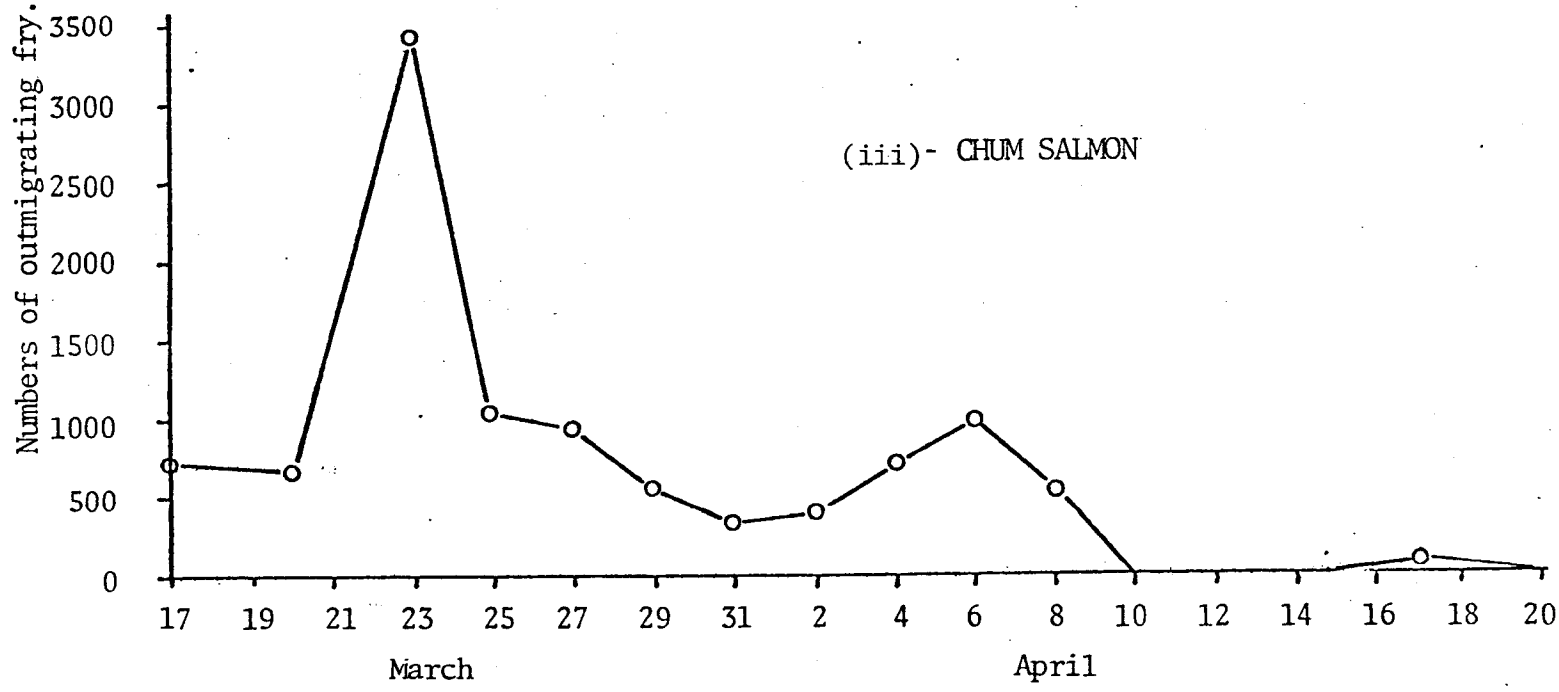


Figure 2 - Comparsion of temperature, water depth and nos. of outmigrating pink fry.

Figure 3 - Comparsion of temperature, water depth and outmigrating chum salmon fry.



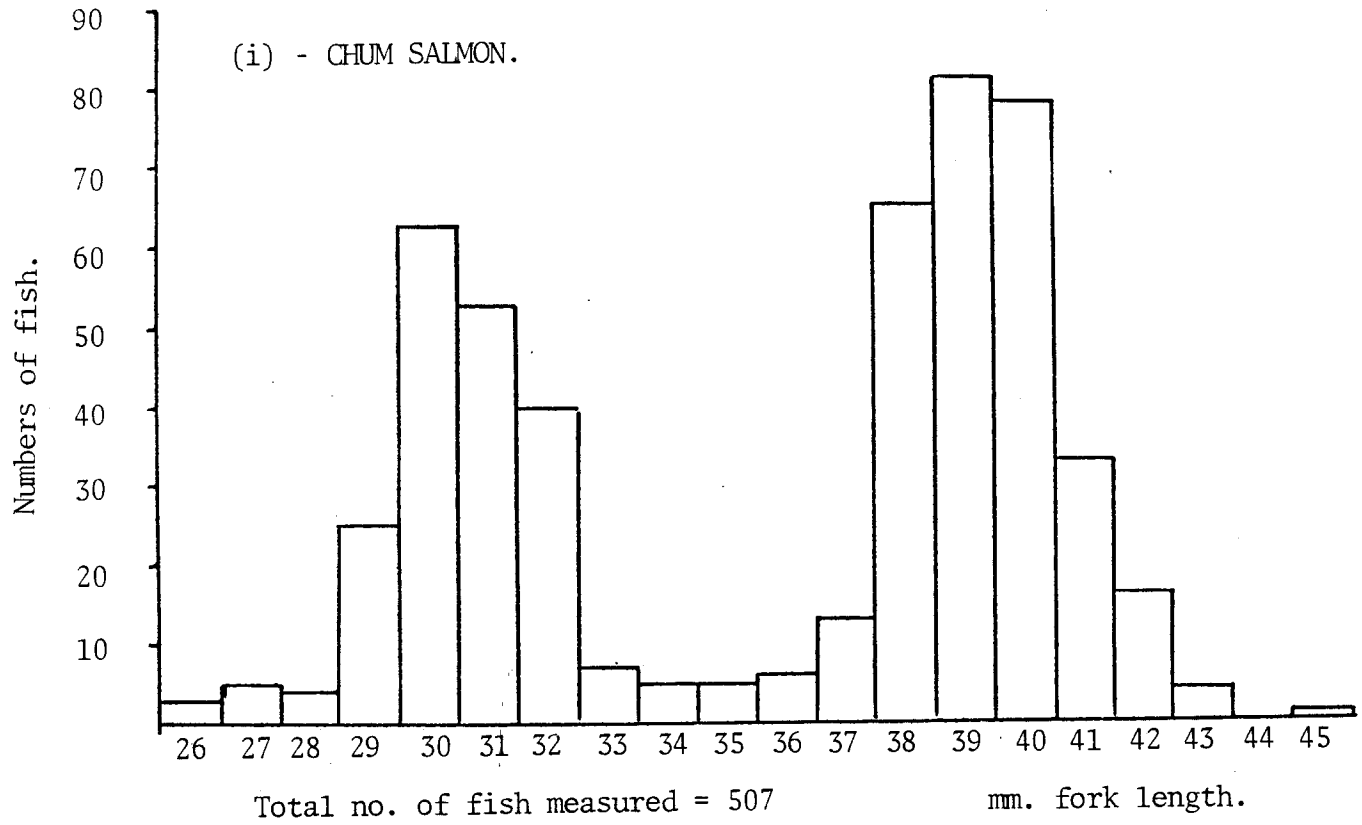


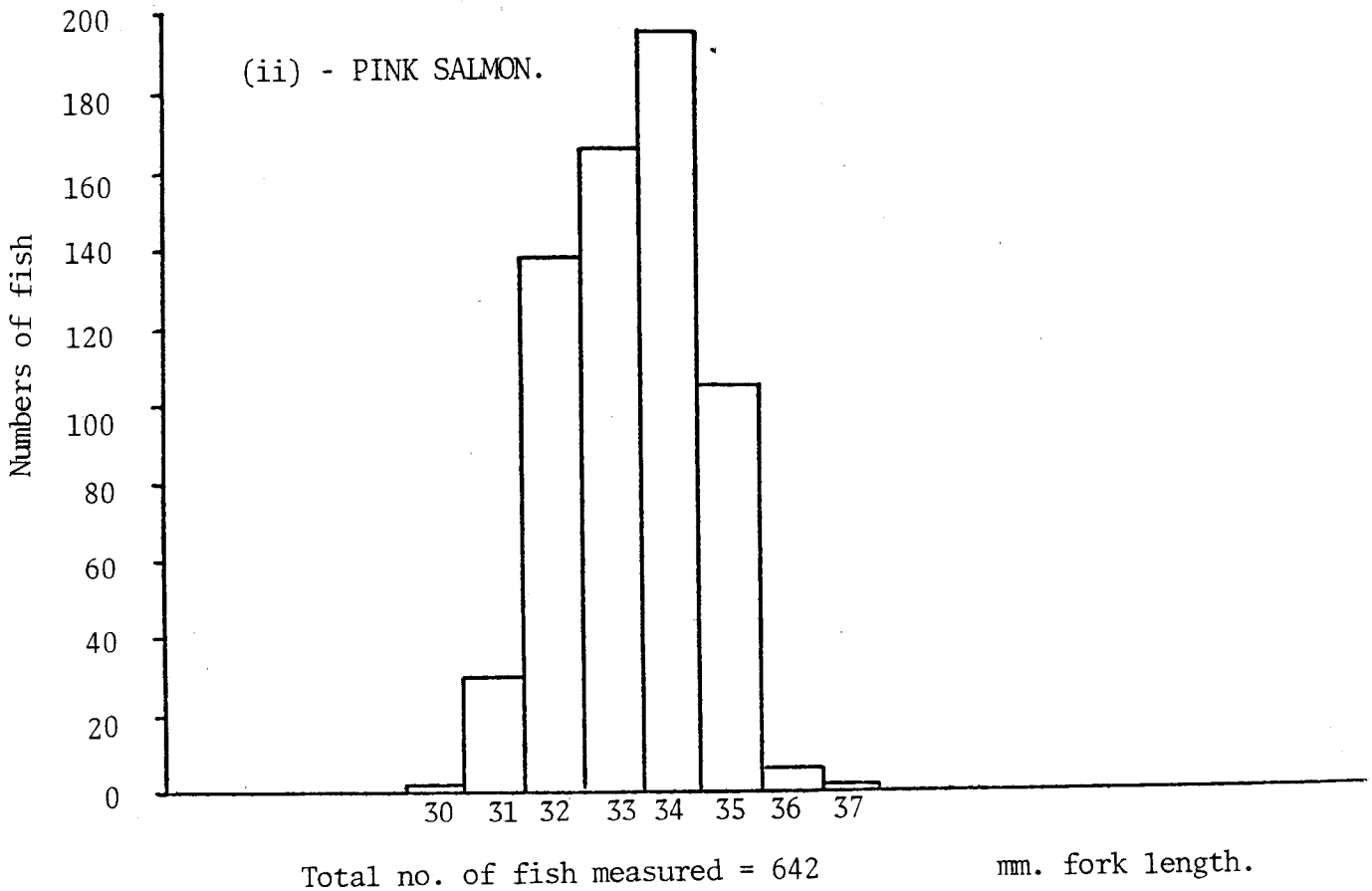


Fork Length (mm)	Numbers Pink	% Pink	Numbers Chum	% Chum
26			3	0.6
27			5	1.0
28			4	0.8
29			25	4.9
30			63	12.4
31	1	0.2	53	10.5
32	30	4.7	40	7.9
33	138	21.5	7	1.4
34	165	25.7	5	1.0
35	195	30.4	5	1.0
36	105	16.4	6	1.2
37	6	0.9	13	2.6
38	2	0.3	65	12.8
39			81	16.0
40			78	15.4
41			33	6.5
42			16	3.2
43			4	0.8
44			0	0
45			1	0.2

Table 1: Length-frequency distribution (numbers and %) of outmigrating pink and chum salmon fry from Black Bear Creek, Spring 1981

Figure 4 - Histograms of length frequency distribution of pink and chum salmon fry from Black Bear Creek, Spring 1981.





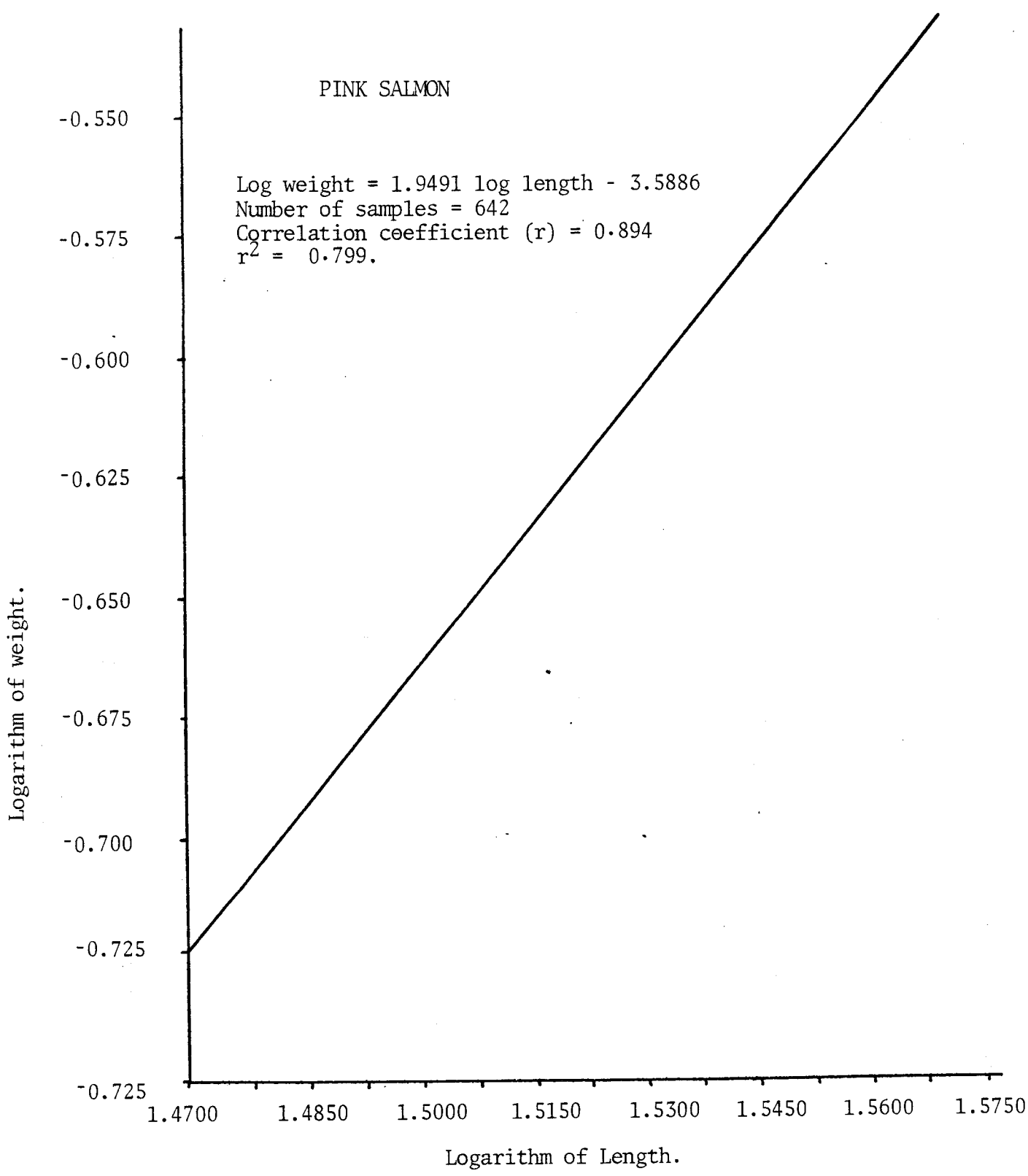


Figure 5 - Length-weight relationship of outmigrating pink salmon fry in Black Bear Creek, Spring 1981.

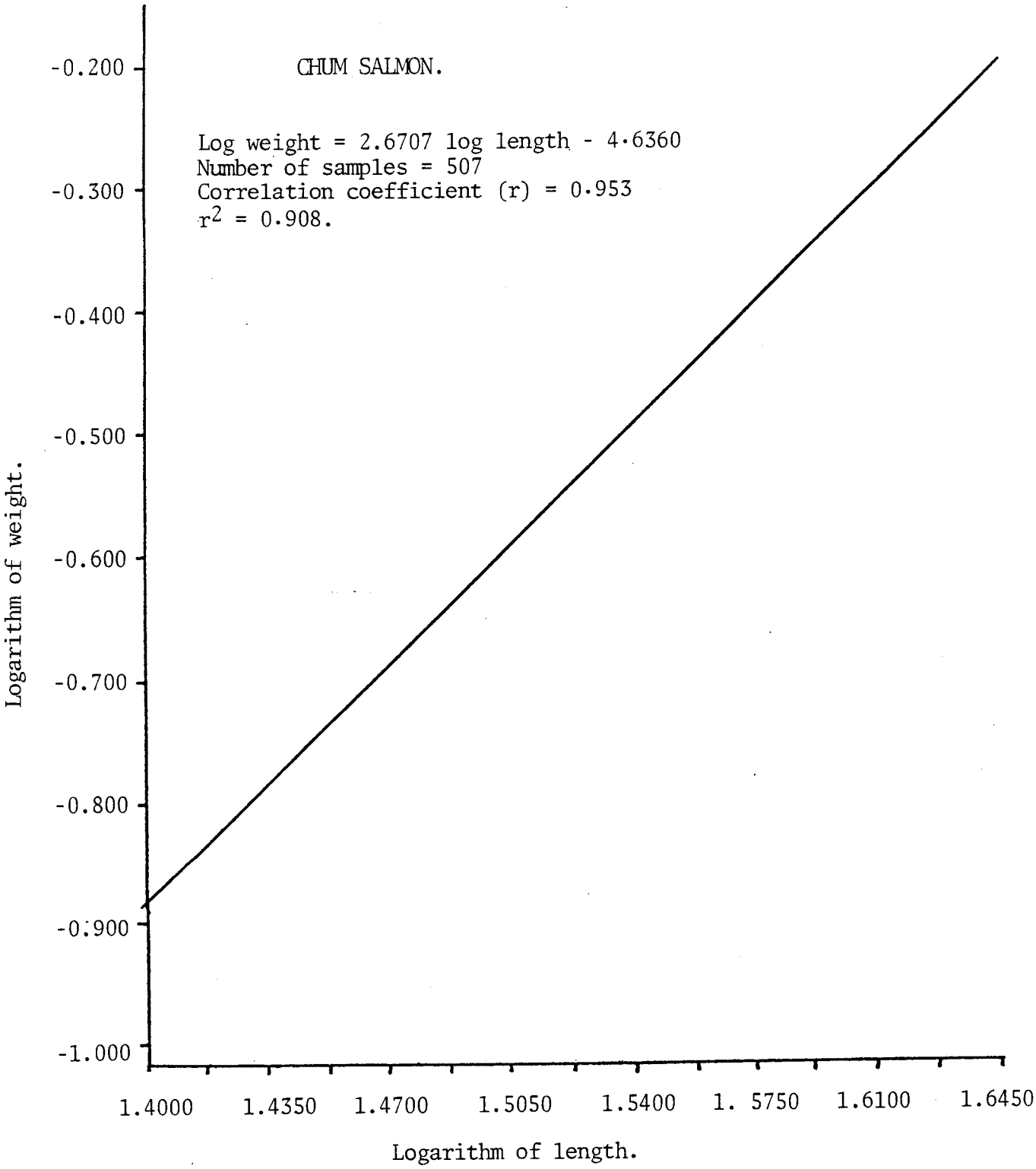


Figure 6 Length-weight relationship of outmigrating chum salmon fry from Black Bear Creek, Spring 1981.

Date	Fish Collected
April 26	3 fry*
April 27	80 fry* 6 were chum 8 coho
April 28	3 fry* 2 coho

* see p 3 for explanation of identification

Table 2: Out-migration of fry from creek into Black Lake

The results of the outmigration from the section of stream above Black Lake are given in Table 2. Initially the fry, other than cohos, were thought to be sockeye but the examination of a small sub-sample proved to be chum fry. It is not possible to assume that all the other fry captured were chum at this point.

No juvenile salmon were collected in the beaver points adjacent to the inlet of the stream to Black Lake.

Discussion :-

From Figure 1 it can be seen that the peak of the outmigration for both pink and chum salmon fry from The Black Bear Creek system occurred between March 21 and March 24. Nearly fifteen and half thousand pink fry and three and half thousand chum fry were captured on March 23. A second peak of pink fry and to a lesser extent chum fry occurred at the beginning of April. The major peak for pink and chum corresponds to a marked rise in stream temperature from 4 ^{o}C to 5.5 ^{o}C and an increase in stream discharge as indicated by the water depth.(Figure 2 & 3) The second peak corresponds directly to a marked increase in stream discharge. The fall from this second peak mirrors exactly a corresponding fall in stream discharge and temperature. Stream discharge, as indicated by water depth, appears related to stream temperature presumably as a function of the higher stream flows being caused by relatively warmer run-off water after periods of rain in comparsion to snowmelt and lake feed.

The importance of water temperature and stream discharge in determing the timing of the major outmigration of pink and chum salmon fry as evidenced by these results has been documented previously. (Bailey and Evans 1971, Combs 1965, Davidson and Hutchinson 1943, Vernon 1958 and Wickett 1958) Consequently the exceptionally mild winter and the marked rise in stream temperature and discharge in late March produced an early outmigration peak in relation to the normal peak which usually occurrs sometime in the middle of April. No written data is yet available to compare with similar stream systems in The Prince of Wales area although an initial appraisal (Hoffmeister pers. comm.) indicates earlier peak

outmigrations than normal, although not as early as March 21 to 25.

Length frequency distribution of pink salmon fry fall within a narrow range with a mean of 33.4 mm (Figure 4). Chum salmon, on the other hand, display two distinct size groups as indicated by Figure 4 , one group falling within predominantly 29 and 32 mm, while the other group is between 38 and 41 mm. There is the possiblity of mis-identification by the local help and that the smaller size class is sockeye fry (Onchorhynchus nerka) but the large number of fish involved in this location near the estuary would seem to indicate this as unlikely as sockeye normally remain in freshwater for a number of years to feed before outmigrating as smolts. This leads to the possiblity that two stocks of chum salmon use The Black Bear Creek system, one stock having a run in summer, the other in the fall, thus accounting for the distinct differences in size groups of the fry. In addition it appears that chum salmon use the section of creek above Black Lake for spawning and there is the possiblity that some of the fry may feed in the lake before migrating seawards,thereby gaining weight and length. However the larger size group was captured throughout the run while the smaller size group were not markedly evident until March 29.

Coho fry normally remain in freshwater to feed but a number become displaced from a system due to competition for rearing habitat and the aggressive behaviour of certain dominant individuals. (Salo and Bayliff 1958, Chapman 1962) These so called 'nomads' move downstream until they reach salt-water and this probably accounts for the coho fry taken in the net at the mouth of the stream near the estuary. These fish can survive and feed in the estuary if sufficient freshwater run-off is present but normally perish in winter unless they can re-enter a stream. The collection of coho migrating into Black Lake supports previous suppositions that the section of stream above Black Lake is an important spawning and rearing habitat for coho. Although large numbers of coho fry were not captured in the net during the three nights of operation , this may have been related to the slow stream flow and that the fry may be able to avoid the net.

No sockeye fry were definitely identified in the system but this is probably more related to the limited amount of work undertaken in the inlet to Black Lake than actual absence.

Length-weight regressions show a better correlation for chums (r^2 = 0·908) compared with pinks (r^2 = 0·799). At the present time it has not been possible to compare this data with populations from other streams in the area but this will be undertaken in the future.

An initial appraisal of the beaver ponds by a limited amount of minnow trapping indicates that they may not be important rearing grounds for coho possibly as a result of their relatively low pH and associated water chemistry.

Summary :-

The peak of the outmigration of pink and chum salmon from The Black Bear Creek system occurred between March 21 and March 24 as result of increased water temperature and stream discharge at that time. This early peak is probably also related to the exceptionally mild winter.

Nomadic coho fry and a small number of coho smolt were found to be moving downstream out of the system.

There may be a summer and a fall run of Chum salmon as a result of two stocks of fish using The Black Bear Creek system.

Chum salmon have been found to spawn in the section of stream above Black Lake.

The beaver ponds near the stream entering Black Lake may not be an important rearing habitat for coho.

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Chapman D.W. (1962) Agressive behaviour in juvenile coho salmon as a cause of emigration. J. Fish Res. Bd. Can. 19 (6) 1047 - 1080.

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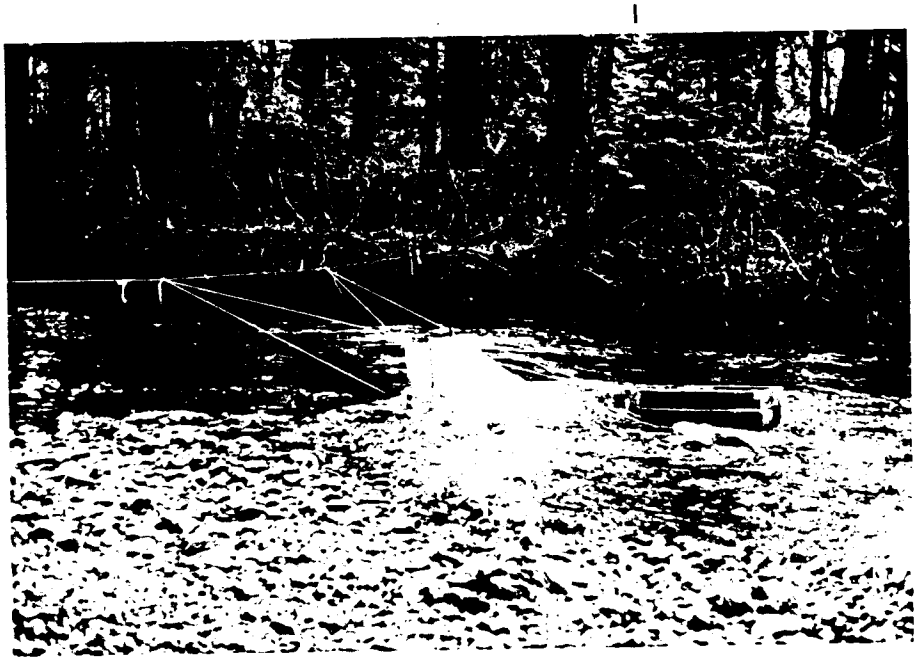
Hoffmeister, K. personal communication. Alaska Department of Fish and Game, Ketchican.

Salo, E. and W.H. Bayliff. 1958. Artifical and natural production of silver salmon, Oncorhynchus kisutch at Minter Creek, Washington. Washington Dept. Fish. Res. Bull. no 4. 79p.

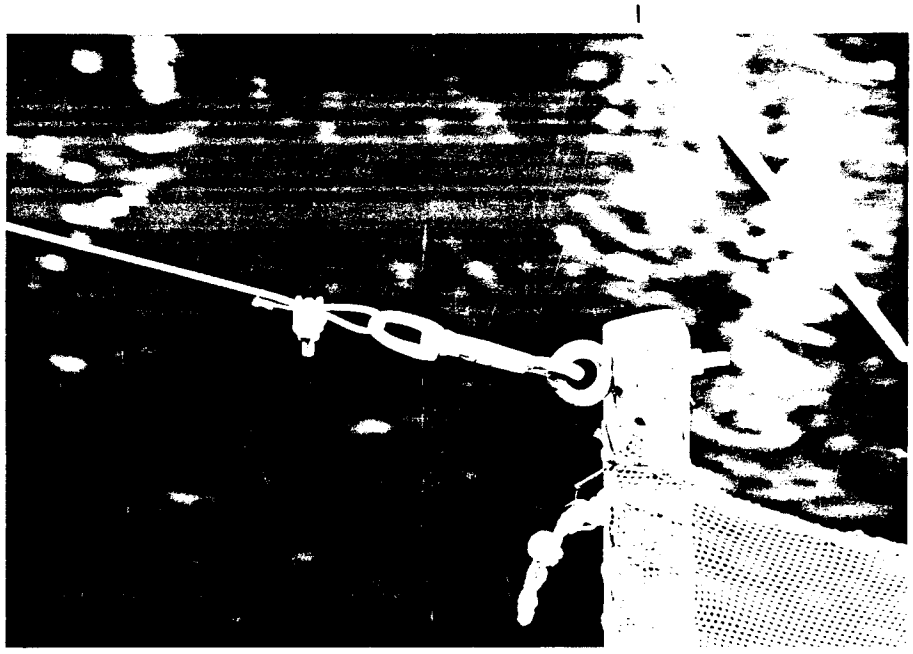
Vernon, E.H. 1958. An examination of factors affecting the abundance of pink salmon in the Fraser River. International Pacific Salmon Fisheries Commission progrees report no. 5 49p.

Wickett, W.P. (1958) Review of certain environmental factors affecting the production of pink and chum salmon. J. Fish Res. Bd. Canada, 15 (5) 1103-1126

APPENDIX



Fyke net and live box attached to cable bwtween two trees at sampling near mouth of Black Bear Creek.

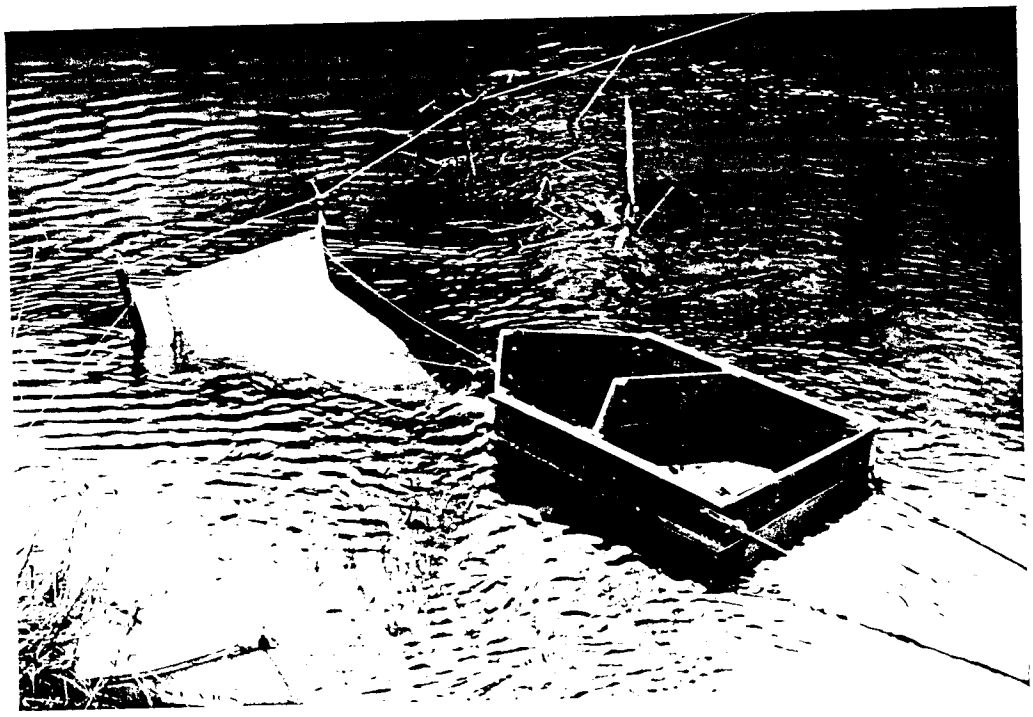


Clips attached to fyke net facilitated easy placement and removal from stream.

Adjusting the position of the live box in the stream.

Emptying fry from live box with a dip net into buckets for numeration.

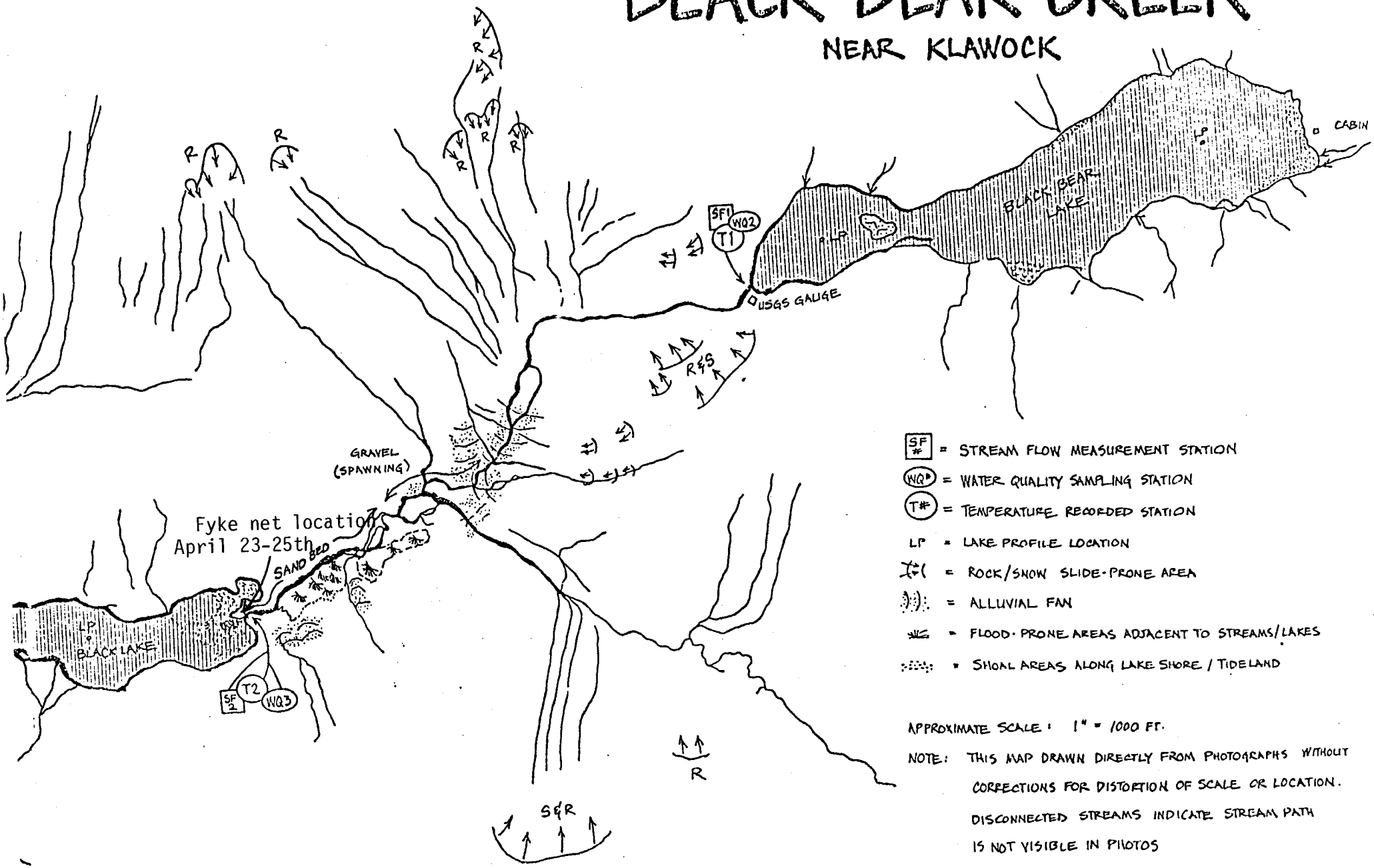
Taking a weight to estimate total number.



Position of fyke net at the inlet of the creek into Black Lake

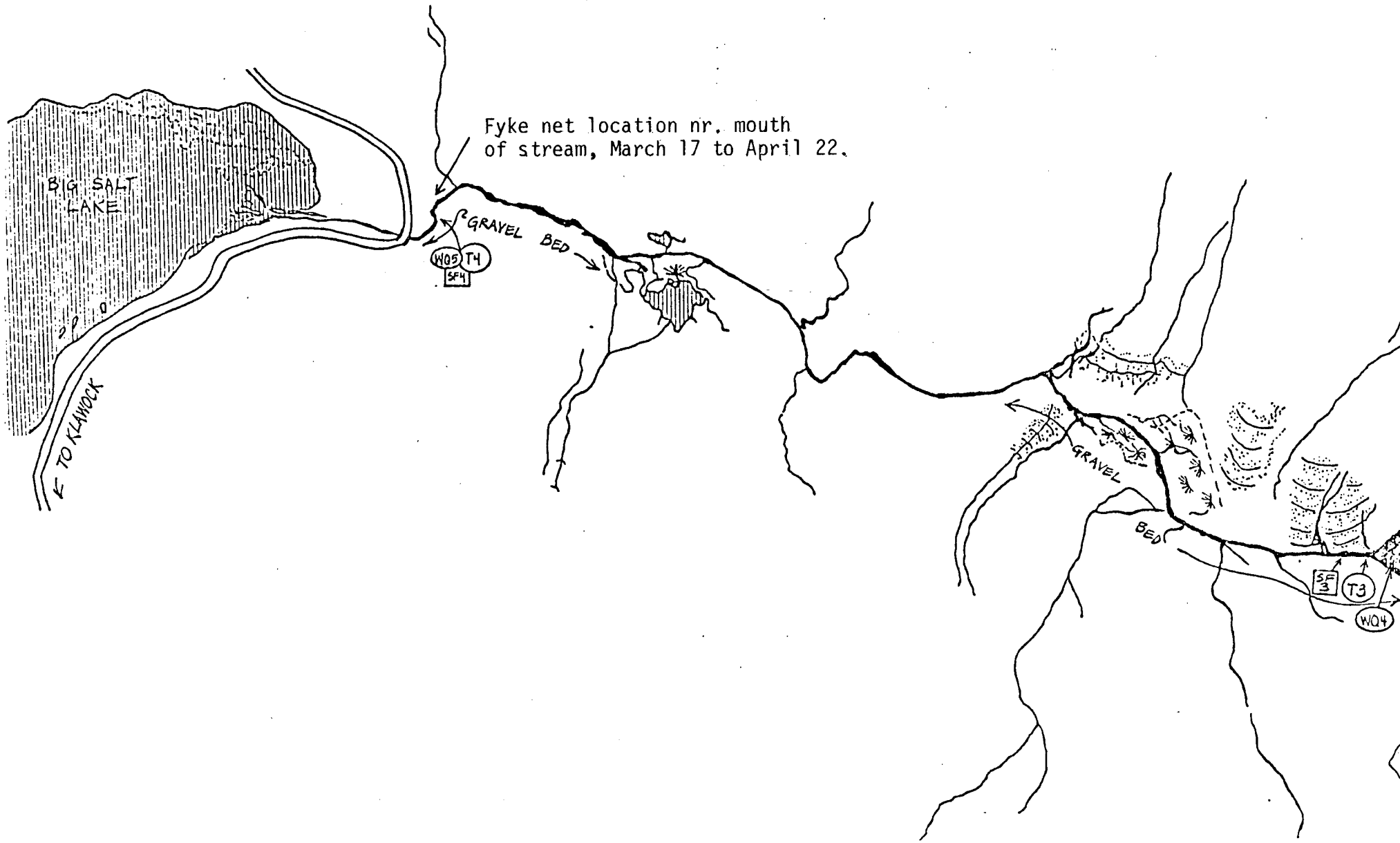
BLACK BEAR CREEK

NEAR KLAWOCK



APPROXIMATE SCALE: 1" = 1000 FT.

NOTE: THIS MAP DRAWN DIRECTLY FROM PHOTOGRAPHS WITHOUT CORRECTIONS FOR DISTORTION OF SCALE OR LOCATION. DISCONNECTED STREAMS INDICATE STREAM PATH IS NOT VISIBLE IN PHOTOS


Fyke net location nr. mouth
of stream, March 17 to April 22.
BIG SALT
LAKE
TO KLAWOCK
GRAVEL BED
WQ5
T4
SF4
GRAVEL
BED
SF
3
T3
WQ4